

Urban Forestry

Postconstruction Storm Water Management in New Development and Redevelopment

Description

Urban forestry is the study of trees and forests in and around towns and cities. Since trees absorb water, patches of forest and the trees that line streets can help provide some of the storm water management required in an urban setting. Urban forests also help break up a landscape of impervious cover, provide small but essential green spaces, and link walkways and trails.

Successful urban forestry requires a conservation plan for individual trees as well as forest areas larger than 10,000 feet². A local forest or tree ordinance is one technique for achieving conservation, and when specific measures to protect and manage these areas are included, urban forests and trees can also help reduce storm water management needs in urban areas.



Trees can be incorporated into urban landscapes for water quality benefits in addition to aesthetic and shade benefits (Source: Tree City USA, no date)

Applicability

From a stream preservation perspective, it is ideal to retain as much contiguous forest as possible. At the same time, this may not be an option in many urban areas. If forested areas are fragmented, it is ideal to retain the closest fragments together.

In rapidly urbanizing areas, where clearing and grading are important, tree preservation areas should be clearly marked. Delineating lines along a critical root zone (CRZ) rather than a straight line is essential to preserving trees and can help reduce homeowner complaints about tree root interference into sewer or septic lines.

Implementation

The concept of the CRZ is essential to a proper management plan. The CRZ is the area around a tree required for the tree's survival. Determined by the tree size and species, as well as soil conditions, for isolated specimen trees, the CRZ can be estimated as 1-1/2 feet of radial distance for every inch of tree diameter. In larger areas of trees, the CRZ of forests can be estimated at 1 foot of radial distance for every inch of tree diameter, or a minimum of 8 feet.

An urban forestry plan should include measures to establish, conserve, and/or reestablish preservation areas. A forest preservation ordinance is one way to set design standards outlining how a forest should be preserved and managed. The ordinance should outline some basic management techniques and should contain some essential elements. The following is a list of some typical elements of a forest conservation plan:

- A map and narrative description of the forest and the surrounding area that includes topography, soils, streams, current forested and unforested areas, tree lines, critical habitats, and 100-year flood plain.
- An assessment that establishes preservation, reforestation, and afforestation areas.
- A forest conservation map that outlines forest retention areas, reforestation, afforestation, protective devices, limits of disturbance, and stockpile areas.
- A schedule of any additional construction in and around the forest area.
- A specific management plan, including tree and forest protection measures.
- A reforestation and afforestation plan.

An ordinance can also be developed that addresses tree preservation at the site level both during construction and after construction is complete. This type of ordinance can be implemented on a smaller scale and can be integrated with a proposed development's erosion and sediment control and storm water pollution prevention plans, which many communities require of new developments.

American Forests, a non-profit organization dedicated to preserving and restoring forests in the United States, adopted an ecosystem restoration and maintenance agenda in 1999 to assist communities in planning and implementing tree and forest actions to restore and maintain healthy ecosystems and communities (American Forests, 2000). The agenda presents the organization's core values and policy goals as the basis for policy statements and as information to help community-based partners to prepare their own policy statements. Key policy goals include

- Increasing public and private sector investment in ecosystem restoration and maintenance activities
- Promoting an ecosystem workforce through training and apprenticeship programs and new job opportunities
- Building support for innovative monitoring systems to ensure collaborative learning and adaptive management
- Encouraging a "civic science" approach to ecosystem research that respects local knowledge, seeks community participation, and provides accessible information for communities.

Limitations

One of the biggest limitations to urban forestry is development pressure. Ordinances, conservation easements, and other techniques that are designed into a management program can help alleviate future development pressures. The size of the land may also limit the ability to protect individual trees. In these areas, a tree ordinance may be a more practical approach.

Forests may also harbor undesirable wildlife elements including insects and other pests. If forests border houses, this may be a concern for residents.

Maintenance Considerations

Maintenance considerations for urban forests may require fringe landscaping and trash pick-up. By using native vegetation and keeping the area as natural as possible, maintenance efforts can be minimized.

Effectiveness

There are numerous environmental and storm water benefits to urban forestry. These include the absorption of carbon dioxide by trees, reduction of temperature, and provision of habitat for urban wildlife. Urban forests can also act as natural storm water management areas by filtering particulate matter (pollutants, some nutrients, and sediment) and by absorption of water. Urban forestry also reduces noise levels, provides recreational benefits, and increases property values.

Urban forests and trees are known to have numerous environmental benefits, including pollutant removal. Trees can absorb water, pollutant gases, airborne particulates, sediment, nitrogen, phosphorous, and pesticides.

There are numerous economic benefits to urban forests, including proven increases in property values. In addition, by preserving trees and forests, clearing and grading as well as erosion and sediment costs are saved during construction. Maintenance costs are also minimized by keeping areas as natural as possible (Table 1).

Table 1: Annual maintenance costs of different types of green spaces (Adapted from Brown et al., 1998)

Land Use	Approximate Annual Maintenance Costs	Source
Natural Open Space: Only minimum maintenance, trash/debris cleanup	\$75/acre/year	NPS, 1995
Lawns: Regular mowing	\$270 to \$240/acre/year	WHEC, 1992
Passive Recreation	\$200/acre/year	NPS, 1995

References

American Forests. 2000. *Forest Policy Center*. American Forests, Washington, DC. [www.americanforests.org/forest_pol/index.html]. Accessed October 23, 2000.

Brown, W.E., D.S. Caraco, R.A. Claytor, P.M. Hinkle, H.Y. Kwon, and T.R. Schueler. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection, Inc., Ellicott City, MD.

National Park Service, Rivers, Trails and Conservation Assistance Program (NPS). 1995. *Economic Impacts of Protecting Rivers, Trails and Greenway Corridors*. 4th ed. National Park Service, Western Office, San Francisco, CA.

Wildlife Habitat Enhancement Council (WHEC). 1992. *The Economic Benefits of Wildlife Habitat Enhancement on Corporate Lands*. Wildlife Habitat Enhancement Council, Silver Spring, MD.

Information Resources

Coder, K.D. 1996. *Identified Benefits of Community Trees and Forests*, University of Georgia, Atlanta, GA.

Fazio, J.R., ed. 1996. *Placing a Value on Trees*. Tree City USA Bulletin #28. The National Arbor Day Foundation, Nebraska City, NE.

Greenfeld, J., L. Herson, N. Karouna, and G. Bernstein. 1991. *Forest Conservation Manual: Guidance for the Conservation of Maryland Forests During Land Use Changes Under the 1991 Forest Conservation Act*. Metropolitan Washington Council of Governments, Washington, DC.

Conservation Easements

Postconstruction Storm Water Management in New Development and Redevelopment

Description

Conservation easements are voluntary agreements that allow an individual or group to set aside private property to limit the type or amount of development on their property. The conservation easement can cover all or a portion of a property and can either be permanent or last for a specified time. The easement is typically described in terms of the resource it is designed to protect (e.g., agricultural, forest, historic, or open space easements) and explains and mandates the restrictions on the uses of the particular property. Easements relieve property owners of the burden of managing these areas by shifting responsibility to a private organization (land trust) or government agency better equipped to handle maintenance and monitoring issues.

Conservation easements are thought to make a contribution to protecting water quality, mostly in an indirect way. Land set aside in a permanent conservation easement is land that will have a prescribed set of uses or activities, generally restricting future development.

The location of the land held in a conservation easement may also determine if it will provide water quality benefits. Property along stream corridors and shorelines can act as a vegetated buffer that may filter out pollutants from storm water runoff. The ability of a conservation easement to function as a stream buffer is related to the width of the easement and in what vegetated state the easement is maintained (see [Buffer Zones](#) fact sheet).

Applicability

Conservation easements are typically done to preserve agricultural lands and natural areas that are facing development pressure on the suburban-rural fringe. For rapidly urbanizing areas, conservation easements may be a way to preserve open space before land prices make the purchase of land containing important cultural and natural features impractical for governmental agencies with limited budgets. Conservation easements are not often used in ultra-urban areas, due to both the lack of available open space for purchase and the high cost of undeveloped land. In addition, private land trusts may limit the size and type of the land that they are willing to manage as conservation easements.

Implementation

Conservation easements are designed to assure that the land is preserved in its current state long after the original owners no longer control the property. By agreeing to give up or restrict the development rights for a parcel of land, a landowner can guarantee that their property will remain in a prescribed state for perpetuity while receiving tax benefits. Often, state agencies and private land trusts have specific qualifications for a property before they will enter into an easement agreement with land owners. Table 1 contains examples of criteria that are used by private land trusts to determine if a property is worth managing in a conservation easement.

Table 1: Typical criteria that land trusts use to determine feasibility of entering into conservation easement agreement

Criteria	Details
Natural resource value	Does the property provide a critical habitat or important environmental aspects worth preserving?
Uniqueness of the property	Does the property have unique traits worth preserving?
Size of land	Is the land large enough to have a natural resource or conservation value?
Financial considerations	Are funds available to meet all financial obligations?
Perpetuity	Is the conservation agreement a perpetual one?
Land trust's mission	Does the property align with the land trust's mission and the organization's specific criteria?

Conservation easements have been used in all parts of the country, and many private groups, both nationally and locally, exist to preserve natural lands and manage conservation easements. States also use conservation easements and land purchase programs to protect significant environmental features and tracts of open space. Maryland is one state that has been nationally recognized for its programs that provide funding for state and local parks and conservation areas. The state is one of the first to use real estate transfer taxes to pay for land conservation programs. Several programs are funded through this transfer tax of one-half of one percent (\$5 per thousand) of the purchase price of a home or land, or other state funding programs. Conservation programs include:

- *Program Open Space.* This program is responsible for acquiring 150,000 acres of open space for state parks and natural resource areas and more than 25,000 acres of local park land. Every county must create a Land Preservation and Recreation Plan that outlines acquisition and development goals in order to receive a portion of the 50 percent that is granted to local governments (MDNR, no date).
- *Maryland Environmental Trust.* This trust is a state-funded agency that helps citizen groups form and operate local land trusts and offers the land trusts technical assistance, training, grants for land protection projects and administrative expenses, and participation in the Maryland Land Trust Alliance (MDNR, 2001a).
- *Rural Legacy Program.* This program is a Smart Growth Initiative that redirects existing state funds into a focused and dedicated land preservation program specifically designed to limit the adverse impacts of sprawl on agricultural lands and natural resources. The program purchases conservation easements for large contiguous tracts of agricultural, forest, and natural areas subject to development pressure, and purchases fee interests in open space where public access and use is needed (MDNR, 2001b).

Regardless of whether a conservation easement is held by a government agency or a private land trust, certain management responsibilities must be addressed by the easement holder. The following is a list of some of these management duties:

- Ensure that the language of the easement is clear and enforceable.
- Develop maps, descriptions and baseline documentation of the property's characteristics.
- Monitor the use of the land on a regular basis.
- Provide information regarding the easement to new or prospective property owners.
- Establish a review and approval process for land activities stipulated in the easement.
- Enforce the restrictions of the easement through the legal system if necessary.
- Maintain property/easement-related records.

Limitations

A number of limitations exist for using conservation easements as a storm water management tool. One is that there is no hard evidence that conservation easements actually do protect water quality. Another is that conservation easements are often not an option in more urbanized areas, where the size, quality, and cost of land can restrict the use of easements. Easements might also not be held in perpetuity, which means that land could still face development pressure in the future. Easements also may not provide for the filtering of pollutants from concentrated flows. More information on the filtering potential of stream buffers can be found in the [Buffer Zones](#) fact sheet.

Maintenance Considerations

The responsibility for maintenance of property in a conservation easement depends on the individual agreement with a land trust or agency. While many organizations assume the responsibility for managing and monitoring a property, some land trusts leave maintenance responsibilities to the landowner and act only to monitor that the terms of the easement are met.

Effectiveness

The pollutant removal efficiency of a conservation area will depend on how much is conserved, the techniques used to conserve it, and the specific nature of the easement. Conservation easements are assumed to contribute water quality benefits, but no national studies proving this have been released.

Cost Considerations

Table 2 summarizes the costs of maintaining green spaces with different types of uses.

Table 2: Annual maintenance costs of different types of green space uses (Adapted from CWP, 1998)

Land Use	Approximate Annual Maintenance Costs
Natural open space Only minimum maintenance, trash/debris cleanup	\$75/acre/year
Lawns Regular mowing	\$270 to \$240/acre/year
Passive recreation	\$200/acre/year

References

Center for Watershed Protection (CWP). 1998. *Costs and Benefits of Stormwater BMPs: Final Report*. Center for Watershed Protection, Ellicott City, MD.

Maryland Department of Natural Resources (MDNR). 2001a. *Maryland Environmental Trust*. [<http://www.dnr.state.md.us/met/>]. Last updated January 4, 2001. Accessed May 22, 2001.

Maryland Department of Natural Resources (MDNR). 2001b. *Rural Legacy Program*. [<http://www.dnr.state.md.us/rurallegacy.html>]. Last updated February 7, 2001. Accessed May 22, 2001.

Maryland Department of Natural Resources (MDNR). No date. *Program Open Space*. [<http://www.dnr.state.md.us/pos.html>]. Accessed May 22, 2001.

Information Resources

Brown, W.E., D.S. Caraco, R.A. Claytor, P.M. Hinkle, H.Y. Kwon, and T.R. Schueler. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection, Inc., Ellicott City, MD.

Daniels, T., and D. Bowers. 1997. *Holding Our Ground: Protecting America's Farms and Farmland*. Washington DC: Island Press.

Diehl, J., and T. Barnett, eds. 1988. *The Conservation Easement Handbook*. Land Trust Alliance and Trust For Public Land, Alexandria, VA.

Schear, P., and T. W. Blaine. 1998. *Ohio State University Fact Sheet: Conservation Easements*. CDFS-1261-98, Land Use Series, Columbus, OH.

Infrastructure Planning

Postconstruction Storm Water Management in New Development and Redevelopment

Description

This practice requires changes in the regional growth planning process to contain sprawl development. Sprawl development is the expansion of low-density development into previously undeveloped land. The American Farmland Trust has estimated that the United States is losing about 50 acres an hour to suburban and exurban development (Longman, 1998). This sprawl development requires local governments to extend public services to new residential communities whose tax payments often do not cover the cost of providing those services. For example, in Prince William County, Virginia, officials have estimated that the costs of providing services to new residential homes exceeds what is brought in from taxes and other fees by \$1,600 per home (Shear and Casey, 1996).



Infrastructure planning makes wise decisions to locate public services—water, sewer, roads, schools, and emergency services—in the suburban fringe and direct new growth into previously developed areas, discouraging low-density development. Generally, this is done by drawing a boundary or envelope around a community, beyond which major public infrastructure investments are discouraged or not subsidized. Meanwhile, economic and other incentives are provided within the boundary to encourage growth in existing neighborhoods. By encouraging housing growth in areas that are already provided with public services—water, sewer, roads, schools, and emergency services—communities not only save infrastructure development costs, but reduce the impacts of sprawl development on urban streams and water quality.

Sprawl development negatively impacts water quality in several ways. The most significant impact comes from the increase in impervious cover that is associated with sprawl growth. In addition to rooftop impervious area from new development, extension of road systems and additions of paved surface from driveways create an overall increase in imperviousness. This increase in the impervious cover level of an area directly influences local streams and water quality by increasing the volume of storm water runoff. These elevated runoff levels impact urban streams in several ways, including enlarging stream channels, increasing sediment and pollutant loads, degrading stream habitat, and reducing aquatic diversity (Schueler, 1995). Sprawl has been reported to generate 43 percent more runoff that contains three times greater sediment loads than traditional development (SCCCL, 1995).

Sprawl development influences water quality in other ways. This type of development typically occurs in areas not served by centralized sewer or water services. For example, over 80 percent of the land developed in the state of Maryland in the last decade has been outside the sewer and water "envelope." This requires new housing developments to use septic systems or another form of on-site wastewater disposal to treat household sewage. These on-site treatment systems can

represent a significant source of nutrients and bacteria that affect both surface waters and groundwater. More information about septic systems is contained in the fact sheets in both the [Illicit Discharge Detection and Elimination Category](#) and the [Pollution Prevention Category](#).

Applicability

Sprawl development occurs in all regions of the country and has recently become the subject of many new programs to counteract its impacts. These programs seldom focus on the water quality implications of sprawl growth, instead concentrating on economic and transportation issues. Even so, methods such as infrastructure planning can reduce the impact of new development. Promoting the infill and redevelopment of existing urban areas in combination with other better site design techniques (see the [other fact sheets in this category](#)) will decrease impervious cover levels and lessen the amount of pollution discharged to urban streams.

Siting and Design Conditions

Various techniques have been used to manage urban growth while conserving resources. Although none of these techniques specifically concentrates on infrastructure planning, each of the techniques recognizes that directing growth to areas that have been previously developed or promoting higher density development in areas where services exist prevents sprawl development and helps communities to mitigate the water quality impacts of economic growth. Among the techniques that have been used are:

- *Urban Growth Boundaries.* This planning tool establishes a dividing line that defines where a growth limit is to occur and where agricultural or rural land is to be preserved. Often, an urban services area is included in this boundary that creates a zone where public services will not be extended.
- *Infill/Community Redevelopment.* This practice encourages new development in unused or underutilized land in existing urban areas. Communities may offer tax breaks or other economic incentives to developers to promote the redevelopment of properties that are vacant or damaged.

The State of Maryland has been one of the states that has recently passed legislation to control growth. This "Smart Growth" legislation allows the State to direct its programs and funding to support locally-designated growth areas and protect rural and natural areas. The central component of this legislative package is the "Priority Funding Areas" legislation that limits most state infrastructure funding and economic development program monies to areas that local governments designate for growth and that meet guidelines for intended use, availability of plans for sewer and water systems, and permitted residential density (MOP, no date).

The other bills in the legislative package also support development of existing areas and preservation of undeveloped land. A brownfields program encourages revitalization of existing neighborhoods and industrial areas and establishes a brownfield revitalization incentive program that provides grants and low-interest loans to fund brownfield redevelopment. A new "Live Near Your Work" pilot program supports this effort by providing cash contributions to workers buying homes in certain older neighborhoods. The "Rural Legacy Program" spurs preservation of undeveloped land by providing financial resources for the protection of farm and forest lands from development and for the conservation of these essential rural resources from development.

Limitations

Intense development of existing areas can create a new set of challenges for storm water program managers. Storm water management solutions are often more difficult and complex in ultra-urban areas than in suburban areas. The lack of space for structural storm water controls and the high cost of available land where structural controls could be installed are just two problems that program managers will face in managing storm water in intensely developed areas.

Infrastructure planning is often done on a regional scale and requires a cooperative effort between all the communities within a given region in order to be successful. Phase II program managers will need to develop lines of communication with other state and local agencies and community leaders to ensure that infrastructure plans direct growth to those areas that will have the least impacts on watersheds and water quality.

Effectiveness

The effectiveness of infrastructure planning at protecting water quality is currently unknown. Although studies exist detailing the economic benefits of infrastructure planning, how this translates to storm water pollutant reductions is difficult if not impossible to calculate. However, a relationship does exist between impervious cover levels and urban stream characteristics, and one can assume that tools such as infrastructure planning that help control imperviousness have a positive impact on water quality.

Compact development benefits program managers in numerous ways. One benefit is that compact development can preserve prime agricultural land and sensitive areas while reducing costly construction of new infrastructure (Pelley, 1997). Less new land developed translates into less need for new infrastructure and public services.

Cost Considerations

The economic benefits of reducing costly construction of new infrastructure and providing new services can be quite substantial. The following is a list of examples of the projected savings of limiting sprawl through managed growth (APA, no date):

- New Jersey's plan for managed growth will save the state \$700 million in road costs, \$562 million in sewer and water costs, \$178 million in school costs, and up to \$380 million in operating costs per year.
- Fifteen years of continued sprawl would cost Maryland \$10 billion more than a more compact pattern of growth.
- A 1989 Florida study demonstrated that planned, concentrated growth would cost the taxpayer 50 percent to 75 percent less than continued sprawl.
- The Cities of Minneapolis-St. Paul will spend \$3.1 billion by the year 2020 for new water and sewer services to accommodate sprawl.
- Since 1980 the City of Fresno, California, has added \$56 million in yearly revenues but has added \$123 million in service costs.

Other studies have found that planned development consumes about 45 percent less land and costs 25 percent less for roads, 15 percent less for utilities, 5 percent less for housing, and 2 percent less for other fiscal impacts (Burchell and Listokin, 1995, as cited in Pelley, 1997).

The control of sprawl development through legislation and "Smart Growth" programs is currently being implemented in a number of states and counties across the U.S. As these programs mature and begin to influence development patterns in urban areas, local governments should begin to see the positive impacts of condensed growth on the aquatic environment and water quality of local streams.

References

- American Planning Association (APA). No date. *Points of View: Paying for Sprawl*. [www.planning.org/info/pointsofview/sprawl.htm]. Accessed May 23, 2001.
- Burchell, R.W., and Listokin. 1995. *Land, Infrastructure, Housing Costs and Fiscal Impacts Associated with Growth: The Literature on the Impacts of Sprawl Versus Managed Growth*. Lincoln Institute of Land Policy, Cambridge, MA.
- Longman, P. 1998. Who Pays for Sprawl? *U.S. News and World Report*. [www.usnews.com/usnews/issue/980427/27spra.htm]. Last updated April 27, 1998. Accessed May 23, 2001.
- Maryland Office of Planning (MOP). No date. *Priority Funding Areas*. [www.op.state.md.us/smartgrowth/smartpfa.htm]. Accessed May 23, 2001.
- Pelley, J. 1997. The Economics of Urban Sprawl. *Watershed Protection Techniques* 2(4):461–467.
- Schueler, T.R. 1995. *Site Planning for Urban Stream Protection*. Metropolitan Washington Council of Governments, Washington, DC.
- Shear, M.D., and W. Casey. 1996, June 21. Just Saying "Yes" to Developers. *The Washington Post*, p. A1.
- South Carolina Coastal Conservation League (SCCCL). 1995. *Land Development Bulletin*. Fall 1995. South Carolina Coastal Conservation League, Charleston, SC.

Information Resources

- Center for Watershed Protection (CWP). 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection, Ellicott City, MD.
- Harbinger Institute. 1998. *Smart Talk for Growing Communities: Meeting the Challenges of Growth and Development*. Prepared for the Congressional Exchange, Washington, DC, by the Harbinger Institute, Kapa'au, HI.
- International City/County Management Association (ICMA). 1998. *Why Smart Growth: A Primer*. International City/County Management Association, Washington, DC.
- Redman Johnston Associates, Ltd. 1997. *Beyond Sprawl: Land Management Techniques to Protect the Chesapeake Bay*. EPA 903-B-97-005. Prepared for the U.S. Environmental Protection Agency, Chesapeake Bay Program, by Redman Johnston Associates, Ltd., Easton, MD.